5.9 NUCLEAR CRITICALITY SAFETY EVALUATION (NCSE) GUIDELINES. This section provides discussions and guidelines for the performance and content of nuclear criticality safety evaluations (calculations) used for defining the technical bases of subcritical limits that are specified in nuclear criticality safety analyses and approvals for fissionable material operations. A "Graded Approach" should be used as described in section 5.6.4.

5.9.1 Personnel Requirements for Performing NCSEs. Only trained, technically competent, authorized, personnel shall perform nuclear criticality safety evaluations/calculations and peer reviews. Qualification of these individuals shall include formal and informal instruction, on-the-job training, and training by peer or Senior Specialist resources and by external sources (as necessary), as discussed in section 5.2.2.

5.9.2 Performance and Documentation of the NCSE. The nuclear criticality safety calculations used to demonstrate subcriticality for actual process nuclear criticality safety analyses shall be reported in a traceable document. The calculations shall be documented in a stand-alone report or be included in a nuclear criticality safety analysis that includes the following:

(a) a verification of the accuracy of the information provided in section 5.7.10.1;

(b) a list of the nuclear parameters, associated controls, and contingencies along with

- a justification for excluding consideration of any nuclear parameters perceived not to be affected by the operation or identified contingencies,
- identification of the method(s) of control (physical and administrative) for each nuclear parameter, and
- identification of contingencies including normal and credible abnormal process conditions and external events such as natural phenomena, floods, and fires; and

(c) an evaluation for each of the controls and contingencies identified that justifies the subcriticality of the fissionable material operation given the failure of a single control or the occurrence of any credible event.

The subcriticality of contingent conditions may be based upon American National Standard Institute (ANSI) consensus standards. Values from other documented sources shall be verified with validated computational techniques, enveloping experimental data, or ANSI/ANS standards values.

Experimentally determined critical data may be used directly to determine NCS specifications provided an adequate margin of subcriticality and safety is justified.

Specific requirements and content for NCSEs are provided in the reference cited in section 2.1.19.

5.9.2.1 Peer review. Before the nuclear criticality safety evaluation may be applied within a nuclear criticality safety analysis used for authorizing a fissionable material operation, a peer review shall independently evaluate the calculations and verify that the above requirements for conducting the NCSE have been satisfied and are correct.

Results of all NCSEs shall be peer reviewed and concurred by a second NCS specialist

(a) to confirm the proper translation from potential criticality scenarios and contingent conditions to appropriate evaluation models for use in a comparative analysis with experimental data, ANSI/ANS values, or computational technique,

(b) to verify that sufficient detail and results of calculational information is available to permit independent review, computations, or comparative analyses of the evaluation models, and

(c) to verify that the evaluation models were actually computed or compared with reference data/values.

Peer acceptability is based on two requirements: technical qualifications and independence, both of which shall be satisfied.

The technical qualifications of the peer reviewer should be at least equivalent to that needed for the original work under review and should be the primary consideration in the selection of a peer reviewer. The peer reviewer should have recognized and verifiable technical credentials in the technical area being reviewed.

In so far as practicable, the peer reviewer should be independent of the original work to be reviewed. Independence means that the peer reviewer was not involved as a participant, immediate supervisor, or advisor in the work being reviewed, and to the extent practicable, has sufficient freedom from funding considerations to ensure that the work is impartially reviewed.

The independence criterion is not meant to exclude eminent scientists, engineers, or onsite nuclear criticality safety specialists qualified as peers upon whose earlier work certain portions of the work under review is based, so long as a general scientific consensus has been reached regarding the validity of his/her earlier work.

Included in the peer review process are the verification of actions and responsibilities for maintaining the quality and integrity of the nuclear criticality safety software system used in support of the contractor installation nuclear criticality safety organization(s). Except when specifically included in a Software Catalog, vendor-supplied systems software such as operating systems, linkers, compilers, and data-base management systems used by the contractor installation are excluded here and covered by separate configuration control for which the contractor is responsible. (See section 5.8 and APPENDIX E.)

An assessment shall be made to ensure the fissionable material operation under consideration has proper radiation detection coverage by the installation or facility CAS or CDS (section 5.4).

5.9.2.2 NCSE documentation. Examples of NCSEs that have been adapted to follow the above guidelines are provided in the reference in section 2.1.19. They were prepared at various DOE facilities and are presented for illustration purposes only.